Introduction

According to Sherlock Holmes, that most English of fictional detectives, 'crime is common, logic is rare'. Holmes prided himself on having made the 'faculties of deduction and logical synthesis' his 'special province'. In one mystery concerning the theft of an expensive race horse, a police officer asks Holmes if any aspect of the crime strikes him as significant. 'Yes', he says, 'the curious incident of the dog in the night time'. 'The dog did nothing in the night time', says the hapless police officer. 'That was the curious incident', replies Holmes. The solution to the crime hinges on the fact that the watchdog guarding the horse did not bark in the night, and from this Holmes deduces that the thief must have been known to the dog. Formally, we can lay out Holmes' reasoning process as follows:

Watchdogs bark at strangers.
The watchdog did not bark at the thief.
Therefore the thief was not a stranger.

This is a good example of the way in which we can acquire new knowledge about the world by using reason. Although we may not have Sherlock Holmes' power of deduction, we are constantly using reason to go beyond the immediate evidence of our senses. You notice that the pavement is wet when you go out in the morning and conclude that it has been raining during the night. You know that you left your mobile phone either in your coat pocket or on your desk; it is not in your coat pocket, therefore it must be on your desk. You know that Lake Geneva is a fresh-water lake, and you know that sharks don't like fresh water; therefore there cannot be any sharks in Lake Geneva.

The benefits of this kind of reasoning are obvious. Take the last example: assuming that your initial assumptions are correct, you don't need to waste your time checking every freshwater lake you come across to see if it has any sharks in it. Reason tells you that you can safely swim in any freshwater lake happy in the knowledge that you will not be attacked by a shark. Similarly, Sherlock Holmes did not need to base his knowledge that the dog knew the thief directly on sense experience, but was able to infer it from what he already knew.

One of the great attractions of reason as a source of knowledge is that it seems to give us certainty. To take a well-known example, given that all human beings are mortal, and given that Socrates is a human being, it *necessarily* follows that Socrates is mortal. There are no 'if's' or 'but's' about it, and it is not a matter of personal opinion or the culture in which you were brought up. Given the assumptions – which in logic are called **premises** – the conclusion *has* to follow. There is no way you can wriggle out of it. After discussing the fallibility of perception in the last chapter, this kind of certainty might seem refreshing, and it is perhaps not surprising that there is a school of philosophy, called **rationalism**, according to which reason is the most important source of knowledge.

The central tenet of rationalism is that we can discover important truths about reality through the use of reason alone. Rationalists are particularly impressed with areas of knowledge such as logic and mathematics, which seem to be both certain and useful; and, unlike their empiricist rivals, they are suspicious of knowledge

based on perception on the grounds that our senses can all too easily mislead us. One of the most famous rationalists in history was René Descartes (1596–1650) who tried to build a system of philosophy on his famous, and allegedly self-evident, starting point, 'Cogito ergo sum' ('I think therefore I am'). Curiously enough, in one of his books Descartes tells us that the idea of building a rational system of philosophy first came to him in a dream!

Whether it is actually possible to build a system of philosophy based purely on reason may be doubted, but reason is clearly an important way of knowing. In what follows, we will look at three kinds of reasoning:

- deductive reasoning
- inductive reasoning
- informal reasoning.

In our discussion, we shall encounter a variety of well-known and commonly committed **fallacies** (i.e. invalid patterns of reasoning) that it is important to guard against. We will then try to come to a balanced assessment of the value and limitations of logic.

1 Which of our faculties do you think is more reliable – reason or perception? Give reasons.

2 The following text is taken from a Calvin & Hobbes cartoon and is an amusing exchange between Calvin and his father. Analyse what Dad says and determine whether or not it is internally consistent.

CALVIN: Dad, how come old photographs are always black and white? Didn't they have color film back then?
DAD: Sure they did. In fact, those old photographs are in color. It's just the world was black and white then.
CALVIN: Really?
DAD: Yep. The world didn't turn color until some time in the 1930s, and it was pretty grainy color for a while, too.
CALVIN: That's really weird.
DAD: Well, truth is stranger than fiction.
CALVIN: But then why are old paintings in color? If the world was black and white, wouldn't artists have painted it that way?
DAD: Not necessarily. A lot of great artists were insane.
CALVIN: But – but how could they have painted in color anyway? Wouldn't their paints have been shades of grey back then?
DAD: Of course, but they turned color like everything else did in the '30s.
CALVIN: So why didn't old black and white photos turn color too?
DAD: Because they were color pictures of black and white, remember?

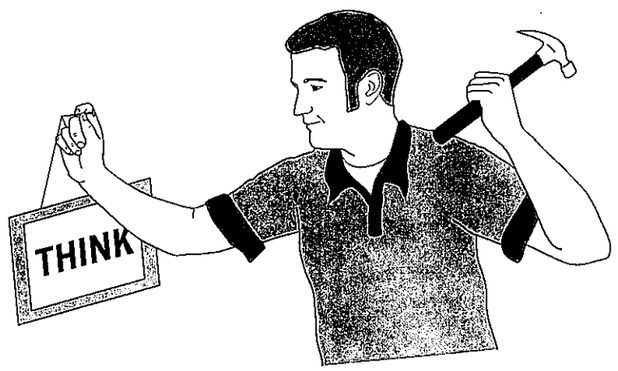

Figure 5.1

Deductive reasoning

Deductive reasoning is any form of reasoning that moves from the general to the particular. For example:

All dogs are mammals.
Fido is a dog.
Therefore Fido is a mammal.

As you can see, the argument moves from a general claim about *all* dogs to a particular conclusion about Fido.

Syllogisms

The above kind of deductive argument is known as a **syllogism**. A syllogism consists of the following items:

1 two premises and a conclusion
2 three terms, each of which occurs twice ('dogs', 'mammals' and 'Fido')
3 **quantifiers**, such as 'all', or 'some' or 'no', which tell us the quantity that is being referred to.

Truth and validity

Before looking at some more examples of syllogisms, we need to make a distinction between **truth** and **validity**. These two words are sometimes used interchangeably, but they do not mean the same thing. Truth is concerned with what is the case, validity with whether conclusions follow from premises; truth is a property of statements, validity of arguments. To avoid confusion, you should not say that an argument is true or false, but rather that it is valid or invalid.

More formally, we can say that an argument is valid if the conclusion follows logically – i.e. necessarily – from the premises. And it is invalid if the conclusion does *not* follow logically from the premises. The main point to grasp is that *the validity of an argument is independent of the truth or falsity of the premises it contains.* Consider, for example, the following syllogism:

All panthers are pink.
Che Guevara is a panther.
Therefore Che Guevara is pink.

Both the premises and the conclusion of this argument are false, but *the argument itself is valid.* To see this, *imagine* a world – call it planet Zog – where all panthers are pink, and Che Guevara is a panther. You can immediately conclude that on planet Zog Che Guevara must be pink!

So, if you want to determine the validity of an argument, imagine that the first premise is true on planet Zog, and imagine that the second premise is true on planet Zog – it doesn't matter whether or not the premises are true on Earth – and then ask yourself whether, on planet Zog, the conclusion must necessarily be the case. If the answer is 'yes', then the argument is valid; if it is 'no', then the argument is invalid. What logic enables you to do is draw conclusions about planet Zog that may not have been obvious from the information you were initially given (the premises).

It is worth noting that an argument can be valid, not only when its premises and conclusion are false – as in the above example – but also when premises are false and the conclusion is true. For example:

All ostriches are teachers.
Richard is an ostrich.
Therefore Richard is a teacher.

In fact, we can construct valid arguments for almost any combinations of true and false premises and conclusions. *The only situation that is impossible is a valid argument with true premises and a false conclusion.*

? Make up your own valid syllogisms to illustrate each of the following.

1 Two true premises and a true conclusion
2 One true premise, one false premise and a true conclusion
3 One true premise, one false premise, and a false conclusion
4 Two false premises and a true conclusion
5 Two false premises and a false conclusion

The structure of arguments

As our discussion has suggested, pure logic is concerned only with the *structure* of arguments. It doesn't matter if the premises are false, or even meaningless. All that matters is that the conclusion logically follows from the premises. Consider, for example, the following syllogism:

All blims are blams.
Some blims are bloms.
Therefore some blams are bloms.

Although 'blim', 'blam' and 'blom' are meaningless words, we can still say with total confidence that if all blims are blams and some blims are bloms, then some blams are bloms. What this means is that, once you have determined that the structure of an argument is valid (or invalid), you can say that any other argument with the same structure will also be valid (or invalid). The argument structure for the above syllogism is:

All *A*s are *B*s.
Some *A*s are *C*s.
Therefore some *B*s are *C*s.

We can substitute anything we like for *A*, *B* and *C* and the argument will always be valid.

Abstracting from the content of an argument and focusing on its structure can help to avoid the danger of **belief bias**. This refers to the tendency we have to believe that an argument is valid simply because we agree with the conclusion. Consider the following argument: 'Democrats are in favour of free speech, and since dictators are not democrats, they are obviously opposed to free speech.' Since you probably agree with the conclusion, you might be tempted to say that the argument is valid. But it is not. The point to take away from this example is *just because you agree with a conclusion does not mean that the argument for it is a good one.*

Using Venn diagrams

Trying to decide whether or not a syllogism is valid is no easy matter. A useful way to picture what is going on is to draw a **Venn diagram**. The example above can be represented in terms of three overlapping circles. To represent 'All *A*s are *B*s', put the circle of *A*s inside the circle of *B*s; and to represent 'Some *A*s are *C*s', have the circle of *C*s intersect the circle of *A*s. You can now see that to the extent that circles *A* and *C* intersect, circles *B* and *C* must also intersect. It therefore follows that 'Some *B*s are *C*s'. The argument is valid.

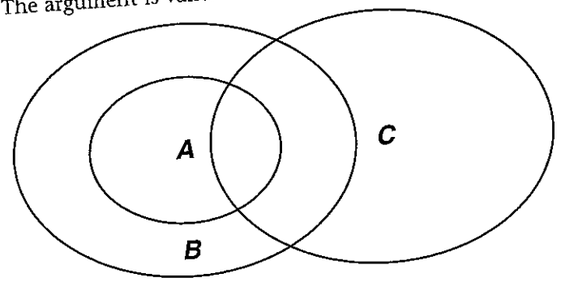

Figure 5.2

You can also use Venn diagrams to show invalid argument structures. For example, the following argument structure is invalid.

All *A*s are *B*s.
All *B*s are *C*s.
Therefore all *C*s are *A*s.

This can be pictured as follows:

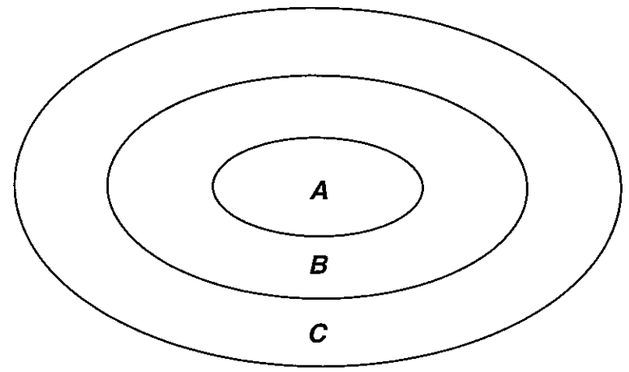

Figure 5.3

You can now see that just because the circle of *A*s falls inside the circle of *B*s, and the circle of *B*s falls inside the circle of *C*s, it does not follow that 'All *C*s are A*s*'. The argument is invalid.

How would you have to change the conclusion in the above example to make the argument structure valid?

If you use Venn diagrams to judge the validity of arguments, you need to be careful about the way you interpret them. Despite appearances, you cannot conclude from Figure 5.2 that 'Some *C*s are not *A*s'. Nor can you conclude from Figure 5.3 that 'Some *C*s are not *A*s'. (Can you see why in each case?) Using Venn diagrams, then, is no substitute for careful thinking; but it can still be a help in solving these kinds of problem.

Using Venn diagrams, state whether each of the following arguments is valid or invalid:

1 All Italians eat spaghetti.
Giovanni Rossi eats spaghetti.
Therefore Giovanni Rossi is an Italian.

2 No Martians have red noses.
Rudolph has a red nose.
Therefore Rudolph is not a Martian.

3 All bull-fighters are brave people.
Some brave people are compassionate.

4 Some monks are Tibetans.
All Tibetans are good at yoga.
Therefore some monks are good at yoga.

5 Some astrologers are frauds.
Some frauds are not wealthy.
Therefore some astrologers are not wealthy.

6 All bobos have dogs.
No doctors have dogs.
Therefore no bobos are doctors.

7 All rookies are red-heads.
All red-heads are runners.
Therefore all rookies are runners.

8 No alphas are betas.
No gammas are betas.
Therefore no gammas are alphas.

Logic: another thing that penguins aren't very good at.

Figure 5.4

Deductive reasoning preserves truth

We have seen that the validity of an argument has nothing to do with the truth or falsity of its premises. So *just because an argument is valid, it does not follow that the conclusion is true.* To be sure that the conclusion of an argument is true, you must be able to answer 'yes' to both of the following questions:

1 Are the premises true?
2 Is the argument valid?

In practice, logic is most useful when we begin with true premises; for if we then reason validly we can be sure that the conclusion is true. Logical reasoning can therefore be seen as a technique for *preserving truth* in the sense that if you begin with truth you will end up with truth. (If, on the other hand, you begin with falsehood, you can end up with anything.)

When people argue in everyday life, they rarely set their arguments out in a formal way, and if a premise strikes them as obvious, they may simply assume it and not bother explicitly stating it. Such an incomplete argument is known as an **enthymeme**.

Supply the missing premise for each of the following enthymemes:

1 Jenny goes to Oxford University, so she must be very intelligent.
2 Drugs should be legalised because they only harm the addict.
3 Graham is a politician so he is probably lying.
4 Cheerleading should be an Olympic event because cheerleaders compete, train and have a high level of physical fitness.
5 Since it is natural to eat meat, there is nothing morally wrong with it.

We have seen that deductive reasoning is an instrument for the *preservation* of truth but this does not mean that it is a *source* of truth. If you go back to the syllogism about Socrates, the conclusion that 'Socrates is mortal' is true only if the premises are true. But how do you know that the premises are true? How, for example, can you be sure that 'All human beings are mortal'? Your knowledge that all human beings are mortal cannot be conjured out of logic, but is based on *experience*. This brings us to the topic of inductive reasoning.

How sure are you that some day you will die? What evidence do you have for your belief?

Inductive reasoning

While deductive reasoning goes from the general to the particular, another kind of reasoning, known as **induction**, goes in the opposite direction – from the particular to the general. With reference to the above example, my belief that all human beings are mortal is a generalisation from a vast number of particular instances. In history, every human being I know of eventually died, and I have never heard of a human being who *didn't* die. Therefore, I can say with confidence that 'All *observed* human beings have died.' But when we reason inductively we typically go further than this and generalise – or make an *inductive inference* – from the observed to the unobserved. Thus, in this example, we move from 'All *observed* human beings are mortal' to 'All human beings are mortal.'

Since inductive reasoning typically moves from the observed to the unobserved, it enables us to make generalisations about the world, and we are constantly using such reasoning in everyday life. Since apples have nourished me in the past, I assume that they will nourish me in the future. Since my neighbour's dog has been friendly to me in the past, I am confident that he will not bite me today. And since my chair has supported my weight in the past, I expect it to continue to do so in the future. In each of these cases past experience shapes our expectations about the (unobserved) future. If you think about it, you will see that you make literally thousands of such inferences every day, and that life would be impossible if you did not assume that most of the regularities that have held in the past will continue to hold in the future.

Indeed, there is a sense in which the whole of language is based on inductive generalisations. For, as we saw in Chapter 3, when we put labels, such as 'teacher', or 'dog' or 'table', on things we are implicitly organising them into general classes so that we can make predictions about them. If you call something a 'table' you have different expectations about its behaviour than if you call it a 'dog'. For example, tables aren't interested in being stroked, and dogs don't like having objects put on them. Thus language might be thought of as the inherited wisdom of the community about how the world is organised; and our tendency to look for regularities in our environment and put labels on them has obvious survival value.

1 If someone says, 'You should never generalise' there is a sense in which they are contradicting themselves. Why is this, and what conclusion do you draw from it?

2 My dog, Fido, gets excited when I get his leash out, and seems to know that he is about to go for a walk. Do you think he is using inductive reasoning to predict what is going to happen in the future? Does this mean that he is able to reason?

Science also uses inductive reasoning and typically formulates general laws on the basis of a limited number of observations. For example if metal *A* and metal *B* and metal *C* expand when heated, at some point a scientist is likely to conclude that *all* metals expand when heated.

What percentage of the metal existing on our planet would you guess scientists have tested to see if it expands when heated? What does this suggest to you about the certainty or otherwise of scientific laws?

Deduction and induction compared

When we compare induction with deduction we can say that the former gives us more information in that it enables us to make generalisations about the world, but the latter is more certain. The difference between the two kinds of reasoning can be summarised in the table below.

Deduction	Induction
Definition	
Reasoning from general to particular	Reasoning from particular to general
Example	
All metals expand when heated. *A* is a metal. Therefore *A* expands when heated.	Metal *A* expands when heated; metal *B* expands when heated; metal *C* expands when heated. Therefore *all* metals expand when heated.
Value	
More certain, but less informative than induction	More informative, but less certain than deduction

In practice, however, deduction turns out to be no more certain than induction. This is because the premises on which deductive reasoning about the world is based must be derived from induction. To see this, go back to the example at the beginning of this chapter. The validity of Sherlock Holmes' conclusion that the thief was known to the dog depends on the truth of the premise that all watchdogs bark at strangers. And we can know that only by induction! Watchdogs *A, B, C, D, E, ...* bark at strangers. Therefore all watchdogs bark at strangers. So Holmes' conclusion is only as certain as the inductive premises on which it is based.

How reliable is inductive reasoning?

Since induction goes beyond the immediate evidence of our senses, we cannot always rely on it. This is because we tend to make *hasty generalisations* and jump to conclusions on the basis of insufficient evidence. For example, if a tourist is served by a rude French waiter, he may conclude that all French people are rude; and if a female fighter pilot crashes a jet her male colleague may conclude that women are unfit to fly. Neither of these conclusions is justified by the evidence, and this kind of faulty reasoning can easily lead to racist or sexist attitudes. The trouble, as the psychologist Gordon Allport (1897–1967) observed, is that, 'Given a thimbleful of facts, we rush to make generalizations as large as a tub.'

Sometimes even well-established generalisations can let us down. With reference to the examples mentioned above, it is always possible that tomorrow apples make me sick, my neighbour's dog savages me, and my chair collapses. Europeans used to believe that all swans are white until they went to Australia and discovered that

some swans are black.You might even question a well-established regularity, such as 'Water boils at 100 degrees centigrade.' After all, it is not true if you are at the top of a mountain!

The tendency to make hasty generalisations is made worse by a phenomenon known as **confirmation bias**. As we saw in Chapter 1, this suggests that people tend to remember only evidence that supports their beliefs and to forget evidence that goes against them. Thus once you have decided that the French are arrogant or that the English are cold, you may notice only examples that confirm your prejudice and overlook those that go against it. This may explain why it is so difficult to change the mind of someone who is in the grip of a prejudice.

?

1 Give three examples of your own of some hasty generalisations.

2 Why do you think that people are so quick to jump to conclusions?

3 What is the difference between a prejudice, a generalisation, and a scientific law?

To illustrate the extent to which we jump to conclusions on the basis of insufficient evidence, consider the following story, which was devised by the psychologist William V. Haney to illustrate precisely this point:

> A businessman had just turned off the lights in the store when a man appeared and demanded money. The owner opened a cash register. The contents of the cash register were scooped up, and the man sped away. A member of the police force was notified promptly.

?

Given the information in the story, respond to each of the 11 statements below by writing next to each one either 'T' if the statement is definitely true, 'F' if the statement is definitely false, and 'U' if the statement is unknown.

1 A man appeared after the owner had turned off his store lights.

2 The robber was a man.

3 The man did not demand money.

4 The man who opened the cash register was the owner.

5 The store owner scooped up the contents of the cash register and ran away.

6 Someone opened a cash register.

7 After the man who demanded the money scooped up the contents of the cash register, he ran away.

8 While the cash register contained money, the story does not state how much.

9 The robber demanded money of the owner.

10 The story concerns a series of events in which only three persons are referred to: the owner of the store, a man who demanded money, and a member of the police force.

11 The following events in the story are true: someone demanded money, a cash register was opened, its contents were scooped up, and a man dashed out of the store.

If you check your responses with the answers given at the end of this chapter, you may be surprised by the extent to which you jumped to various false conclusions on the basis of the information that was given to you.

What distinguishes good generalisations?

Since generalisations sometimes lead us into trouble, we need to think about how to distinguish good ones from bad ones. Here are some relevant general criteria:

1 *Number* You should look at a reasonable number of instances. If you see one example of a dog swimming, this is clearly not enough to conclude that 'all dogs can swim', and you should look at a lot more cases.

2 *Variety* You should look at a variety of circumstances. In the above example, you might look at different breeds of dogs, young dogs, old dogs, etc.

3 *Exceptions* You should actively look for counter-examples. You might, for example, ask if anyone has a dog that cannot swim. This will help to guard against confirmation bias.

4 *Coherence* You should demand more evidence to support surprising claims than unsurprising ones. It would take more to convince me that all dogs can walk on their hind legs than that all dogs can swim.

5 *Subject area* You should be aware of the subject area you are dealing with, and keep in mind that generalisations tend to be more reliable in the natural sciences than in the social sciences. For example, if you heat copper sulphate crystals they always turn from blue to white; but when you do experiments with dogs, the results are much less predictable. Indeed, according to the so-called Harvard law of animal behaviour, 'Under carefully controlled experimental circumstances an animal will behave as it damned well pleases.' And the behaviour of human beings – the most complex and contrary of animals – is, of course, the most difficult to predict of all. That is why there are a greater number of reliable generalisations in chemistry than in economics.

Although the above criteria can help us to distinguish between more and less reasonable generalisations, they are not precise rules. How many times should a team of scientists repeat an experiment before concluding that they have discovered a new law of nature? We can give some general advice, such as 'Many times if the experiments deal with complex phenomena or give unexpected results'. But there is not a number we can stipulate such as seven or twenty-three. All we can say is that the greater the number of confirming instances the more confident we can be about the generalisation.

Informal reasoning

In the last two sections, we looked at some fallacies associated with deduction and induction, such as invalid syllogisms and hasty generalisations. We will now consider some other fallacies that crop up frequently in arguments and discussions.

Post hoc ergo propter hoc

The fallacy of *post hoc ergo propter hoc* (literally, 'after this, therefore on account of this') consists of assuming that because one thing, *B*, follows another thing, *A*, then *A* must be the cause of *B*. For example, just because the murder rate in a country goes up after the abolition of capital punishment, it does not necessarily follow that capital punishment is an effective deterrent. The increase in the murder rate could be explained by other factors – such as a rise in poverty or the greater availability of guns. Notice that we said 'it does not *necessarily* follow that capital punishment is an effective deterrent'. The point is that while it *could be* the case, we cannot jump to this conclusion simply from the fact that the murder rate has gone up. We need more evidence.

Even when one event, A, is *regularly* followed by another event, B, it still does not necessarily mean that A is the cause of B. For example night is *regularly* followed by day, but night is not the *cause* of day. The evening weather forecast is *regularly* followed by the next day's weather, but the forecast does not *cause* the weather. The purchase of wedding rings is regularly followed by weddings, but the rings do not cause people to marry. In each of the above cases, the event in question is caused by some other factor – the rotation of the earth on its axis, pre-existing weather conditions, the decision to marry.

? How would you explain the well-known observation – supported by statistical evidence – that as the number of churches in American cities increases, so does the number of prostitutes?

We need to be careful that we do not claim that this fallacy is being committed when in fact it is not. For example, for many years the American tobacco industry admitted that there was a statistical correlation between smoking and cancer, but denied that there was a causal connection. They implied that people who said 'Smoking causes cancer' were committing the *post hoc ergo propter hoc* fallacy. A clever ploy, but the fact is that, in addition to this statistical correlation, there is a large amount of other evidence that smoking causes cancer.

In general, we can say that a correlation between two things may be a *preliminary* indication that there is a causal connection between them. If, for example, I notice that the incidence of heart disease is lower in people who drink a glass of red wine every day than in the general population, it may be worth investigating this in more detail. A fallacy is only being committed if we immediately jump to the conclusion that red wine prevents heart disease.

Ad hominem fallacy

The *ad hominem* fallacy (literally, 'against the man') consists in attacking or supporting the person rather than the argument. If, for example, you make an argument for world government, and are told that you are too young and idealistic to know what you are talking about, that is *ad hominem*. Rather than critiquing your argument, your opponent is simply attacking *you*. Similarly, if I make a case for higher salaries for teachers, and you reject what I say on the grounds that as a teacher I *would* say that, then that, too, is *ad hominem*. The fact that as a teacher I might have a **vested interest** in teachers getting higher salaries may, of course, make you *suspicious* of my argument, but it is not in itself a reason for rejecting it. You need to look at what I actually say.

Although the *ad hominem* fallacy is usually committed by *criticising* someone, it can also be committed by *supporting* them. For example, if you say 'Einstein was in favour of world government, so it must be a good thing', you are again focusing on the speaker rather than the argument. The same mistake arises when we appeal to what 'most people' or the 'vast majority' believe in order to justify something. Just because the vast majority of people believe something doesn't mean it is true. After all, there was a time when most people believed that it was acceptable to keep slaves and that women shouldn't be allowed to vote.

The above discussion raises the question of whether we are *ever* justified in taking an argument on trust from someone else. I suppose the ideal would be to always work everything out for ourselves; but in practice we lack the time and expertise to do this. Given this, it seems more reasonable to take an argument on trust from someone if they are an *authority* in the relevant area than if they are not. So if you say, 'It must be true because Einstein said so', this carries more weight if we are discussing relativity theory than if we are discussing politics or religion – areas in which Einstein has no particular authority. In this context, it is worth bearing in mind Hans Eysenck's (1916–97) comment:

> Scientists, especially when they leave the particular field in which they have specialised, are just as ordinary, pig-headed and unreasonable as anybody else, and their unusually high intelligence only makes their prejudices all the more dangerous.

We might now ask whether we are ever justified in *rejecting* what someone says solely on the basis of who they are. If, for example, you were a juror in a criminal trial and discovered that one of the eye-witnesses had a history of telling lies, would you be committing the *ad hominem* fallacy if you rejected his evidence out of hand? Well, if someone has a history of lying, you should clearly not take what he says at face value. But since it is at least possible that *this time* he is telling the truth, you should at least listen to his testimony and see how consistent it is with the rest of the evidence.

Circular reasoning

Circular reasoning (also known as 'vicious circle' and 'begging the question') consists in assuming the truth of something that you are supposed to be proving. When someone commits this fallacy, what at first sight looks like an argument, turns out to be nothing more than a reassertion of their position. Imagine that someone says, 'I know that Jesus was the Son of God because he said he was, and the Son of God would not lie.' They are begging the question because they are *assuming* the very

thing that they are supposed to be *proving* – namely that Jesus was the Son of God. The philosopher Anthony Flew gives another nice example of circular reasoning:

> Three thieves are arguing about how to divide up the seven pearls they have stolen. One of them picks up the pearls and gives two to each of the other two, keeping the remaining three for himself. One of the other men says 'How come you have kept three?' 'Because I am the leader.' 'Oh. But how come you are the leader?' 'Because I have more pearls.'

Special pleading

The fallacy of 'special pleading' involves the use of double standards – making an exception in your own case that you would not find acceptable if it came from someone else. For example, if your neighbour says 'I know there is a drought and we need to save water, but I am putting my prize flowers in a competition next week and I need to give them plenty of water', this is an example of special pleading. He is giving a justification for his behaviour that he would not accept if it were given by somebody else.

? Imagine in the above example that you accuse your neighbour of special pleading, and he says 'No I'm not. Despite the drought, I think that everyone with prize flowers should be allowed to water them.' Is he still engaging in special pleading?

Human beings tend to be rather good at special pleading – perhaps because there are many situations in which it would be convenient if everyone followed the rules *except me*. We will look in more detail at our tendency to make exceptions in our own case when we consider ethics in Chapter 12.

Equivocation

Equivocation is a fallacy that occurs when a word is used in two different senses in an argument. Consider the following syllogism:

> A hamburger is better than nothing.
> Nothing is better than good health.
> Therefore a hamburger is better than good health.

Although this argument is formally valid in the sense that the conclusion follows from the premises, there is clearly something wrong with it. The problem lies with the word 'nothing' because it has a different meaning in each of the premises. In the first premise, it means 'not having anything'; in the second, it means 'there is not anything'. The second premise is clearly not intended to mean that 'not having anything' is better than having good health. In practice, it is not always easy to tell if someone is using a word consistently or not. This may be why so many arguments end up being about the meanings of words.

Argument *ad ignorantiam*

You commit the fallacy of argument *ad ignorantiam* if you claim that something is true on the grounds that there is no evidence to disprove it. We discussed this fallacy in Chapter 1, but here is an example to refresh your memory. During the 'witch hunt' against communists in the USA in the early 1950s, Senator Joe McCarthy's case against one alleged communist was that 'there is nothing in the files to disprove his communist connections'. The point is, of course, that to show that someone is a communist – which is, in any case, no crime – we need *positive* evidence of their political affiliation.

? In most legal systems, someone who is accused of a crime is considered to be innocent until proved guilty. Is this an example of argument *ad ignorantiam*? If so, does this mean that we should abandon the assumption that someone is innocent until proved guilty?

The particular relevance of this fallacy to TOK is nicely expressed by the biologist Richard Dawkins (1941–): 'There is an infinity of possible things that one might believe – unicorns, fairies, millions of things – and just because you can't disprove them it doesn't mean there is anything plausible about them.'

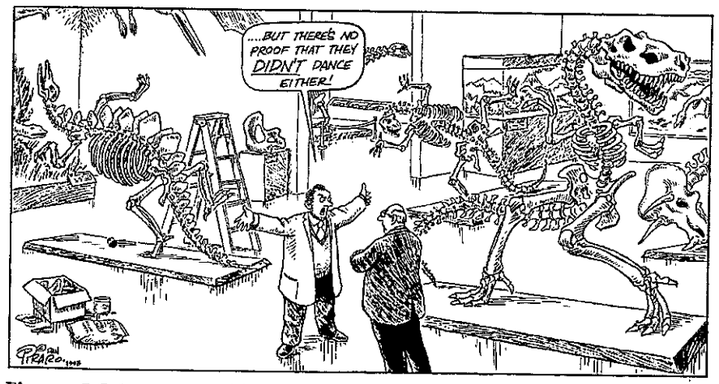

Figure 5.5 Argument *ad ignorantiam*

False analogy

In trying to persuade people of something, you might use various analogies to support your argument, and this can be an effective rhetorical device. A false analogy arises when you assume that because two things are similar in some respects they must also be similar in some further respect. Consider the following syrupy example: 'Just as in time the gentle rain can wear down the tallest mountains, so, in human life, all problems can be solved by patience and quiet persistence.' Well, maybe and

maybe not. The point is that there is not much of a similarity between the action of rain on mountains and that of patience on problems. For one thing, it takes millions of years for mountains to be worn down by the action of rain, and when it comes to solving problems we don't have that kind of time.

False dilemma

This is the fallacy of assuming that only two alternatives exist when there is in fact a wider range of options. If, for example, someone says 'Do those who advocate an increase in military expenditure really want to see our schools and hospitals close?' they are implying that we have only two choices: *either* we increase military expenditure *or* we keep our schools and hospitals open. Since you are probably in favour of keeping schools and hospitals open, you seem forced to conclude that we should not support an increase in military expenditure. But there may in fact be more than two choices. For example, if we raise taxes we might be able to increase military expenditure *and* keep our schools and hospitals open. (Of course, if there really are only two choices, then this kind of reasoning is perfectly valid. If John Smith is either alive or dead, and he is not dead, then it follows that he must be alive.)

One reason that false dilemma is a common fallacy is that we tend to see the world in black and white terms. (Someone once said that, 'The world is divided into those who divide things into two types and those who don't.') Such **binary thinking** may have served our ancestors well; for their survival must often have depended on making quick friend-or-foe, fight-or-flight type of decisions. However, it may not be as useful in the modern world where many issues are not black and white, but various shades of grey.

Loaded questions

A loaded question is one that contains a built-in assumption that has not been justified and may be false. For example, if someone says 'Do you always cheat in exams?', then if you answer 'yes', you are admitting that you always cheat, and if you answer 'no' you are implying that you *sometimes* cheat. What you have to do is challenge the assumption built into the question and say 'I *never* cheat in exams.'

When governments hold referenda, or social scientists or polling organisations seek to gather data of various kinds, they should try to avoid loaded questions. But in practice it may be difficult to decide whether a question is biased or not; for, as we saw in Chapter 3, it is difficult to express anything in a completely neutral way. We shall have more to say about the problem of loaded questions when we discuss the social sciences in Chapter 9.

Statements may also contain built-in assumptions. A sentence such as 'The headteacher was not drunk today' may in a narrow sense be true. But it carries with it the implication that this is unusual and that he or she is often drunk – and, in most schools at least, this is likely to be false.

? Imagine that the Norwegian government has decided to hold a referendum about whether or not Norway should join the European Community. Your job is to phrase the referendum question in as neutral and unbiased a way as possible. What is your question? And why did you choose to phrase it the way you did?

Fallacies: a summary

We have now considered nine informal fallacies. If we add to these the fallacy of hasty generalisation from the previous section, we can speak of the 'ten deadly fallacies' of informal reasoning, which are summarised in the table below.

The ten deadly fallacies	
Ad ignorantiam	Claiming something is true because it cannot be proved to be false
Hasty generalisation	Generalising from insufficient evidence
Post hoc ergo propter hoc	Confusing a correlation with a causal connection
Ad hominem	Attacking/supporting the person rather than the argument
Circular reasoning	Assuming the truth of what you are supposed to be proving
Special pleading	Using double standards to excuse an individual or group
Equivocation	Using language ambiguously
False analogy	Assuming that because two things are alike in some respects they are alike in other respects
False dilemma	Assuming that only two black and white alternatives exist
Loaded question	A question that is biased because it contains a built-in assumption

As we have seen, it requires an element of judgement to determine whether or not one of the above fallacies has been committed; and it is worth noting that one of the most common fallacies is to falsely claim that someone has committed a fallacy!

?

In each of the twenty cases described below, state which of the following best applies to the argument:

A Valid
B Invalid syllogism
C Hasty generalisation
D *Post hoc ergo propter hoc*
E Circular reasoning
F *Ad hominem* fallacy
G Special pleading
H Argument *ad ignorantiam*
I False dilemma
J False analogy
K Equivocation
L Loaded question

1 Since strict gun control laws were introduced in Dodge City, the crime rate has risen. This shows that gun control does nothing to reduce crime.

2 Arisa said she trusted me, and she must be telling the truth because she wouldn't lie to someone that she trusted.

3 The ends justify the means. After all, if you want to make omelettes, you have to break eggs.

4 Since the English always talk about the weather, if you meet someone who talks about the weather you can be sure they are from England.

5 That can't be right. None of my friends would believe it.

6 Since many great scientists have believed in God, there must be some truth in religion.

7 We got on very well on both of our dates together. We are clearly well-suited. Let's get married!

8 Do you want to be part of the solution or part of the problem?

9 I agree that everyone should pay their taxes. But since I'm short of money this year and want to take my family on a much-needed holiday, it's OK if I don't declare my full income.

10 The average UK family has 2.5 children. The Smiths are very average people. Therefore they must have 2.5 children.

11 Since no one has been able to prove that we are alone in the universe, we must conclude that alien life-forms exist.

12 Are all your family stupid, or is it just you?

13 Many great artists were not recognised in their own lifetimes. Since my work has not been recognised, I must be a great artist.

14 Since there are two candidates for student president – Boris and Bertha – and I know he did not vote for Boris, he must have voted for Bertha.

15 As no one succeeds without hard work, the fact that you failed your exams shows how idle you have been.

16 No breath of scandal has ever touched the senator. So he must be an honest man.

17 Just as you are more likely to take care of a car that you own than one that you rent, so a slave owner is more likely to take care of his slave than an employer is of his worker.

18 To ignore the possibility that America was discovered by Africans simply because these explorers are unknown is irresponsible and arrogant. If we are unaware of an event, it does not mean it never happened.

19 In the fight against terrorism, you are either with us or against us.

20 The English can't cook. If he really is English, then obviously he won't be able to cook.

Causes of bad reasoning

If we ask ourselves why we sometimes reason poorly, and commit, or fail to recognise, the above kinds of fallacy, I think there are four main reasons: *ignorance, laziness, pride* and *prejudice*. In some cases, we do not realise that a particular form of reasoning is fallacious, and are taken in by it. In other cases, we have developed fixed habits of thinking and are too lazy to check the argument or see if it has supporting evidence. Perhaps it is psychologically easier to hold simple beliefs with confidence than get bogged-down with confusing details. Pride also plays a role in bad reasoning; for although we all like to think we are open-minded, once we get involved in an argument we can become more interested in winning than in establishing the truth. Unfortunately logic, the art of reasoning, can all too easily give way to rhetoric, the art of persuasion. And we may then be tempted to resort to any argument – valid or invalid – to defend our position. Indeed, on some occasions, we may simply begin with our prejudices, and then manufacture bad reasons in order to justify them. This is known as **rationalisation**, and we shall have more to say about it in Chapter 6.

?

Take any editorial or opinion article from a newspaper and see how many of the above fallacies you can find in it.

Reason and certainty

We have considered three different kinds of reasoning – deductive reasoning, inductive reasoning and informal reasoning. The fact that fallacies can arise with each of these suggests that we cannot always rely on reason to give us knowledge. Furthermore, we have seen that, when it comes to reasoning about the world, the conclusions of deductive arguments are no more certain than the premises they are based on. In practice, then, it would seem that, at best, reason is a means of preserving truth in the sense that if you begin with truth and reason validly then you will end with truth.

We might, however, say that, *as a way of thinking*, logical reasoning cannot really be doubted. Such reasoning is based on the following three **laws of thought**.

1 *The law of identity*. If *A*, then *A*. For example, 'If something is a banana, then it is a banana.'
2 *The law of non-contradiction*. Nothing can be both *A* and not-*A*. For example, 'Nothing can be both a banana and not-a-banana.'
3 *The law of the excluded middle*. Everything is either *A* or not *A*. For example, 'Everything is either a banana or not a banana.'

These three laws probably strike you as self-evident. If something is a banana, then it must be a banana. And given that it's a banana then it cannot *not* be a banana. Finally, if you put all the bananas in the universe on your left, and all the non-bananas on your right, there is nothing left in the middle hovering uncertainly between being and not being a banana. (A banana with an identity crisis, perhaps? A banana that has gone bananas?)

What, then, should we say to someone who asks 'Why should I be logical?' At one level, the question is self-defeating because in asking for reasons you are implicitly presupposing the value of logic. A statement such as 'Logic isn't useful' is equally self-defeating; for, in making it, you presumably wish to exclude the contrary idea that logic *is* useful, and you are therefore presupposing the usefulness of the principle of non-contradiction. The fact is that logic is presupposed in all meaningful communication, and any assertion *p* that you care to make must – if it is to say anything – exclude the contrary assertion *non-p*.

'But can't a man and a wife have a love–hate relationship?' you might ask. 'And, if so, doesn't that mean that you can both love and not-love someone?' Well, this is true in a sense, but not in a way that undermines logic. For you cannot love and not love the same person in the same way at the same time. What you really mean when you say you have a love–hate relationship with someone is that you love them in certain ways or at certain times, but not in other ways or at other times. And this, of course, does nothing to invalidate logic. (A man once explained his love–hate relationship with his wife as follows. 'It's quite simple', he said. 'I love her and she hates me!')

'You still haven't proved that the laws of logic are true', you might persist – 'you have just assumed that they are true'. This is admittedly true; but this follows from the fact that *all proof must end somewhere*. And since we cannot prove everything, where better to start than with principles that seem self-evident and are the basis for meaningful communication? In the end if someone ignores logic and keeps contradicting themselves, we are likely to get frustrated and will probably stop talking to them.

?

1 Find out what is meant by the phrase **infinite regress** and explain why all proof must end somewhere.
2 What is the difference between being irrational and being insane? How irrational must someone be before you classify them as insane?

Can deductive reasoning be doubted?

Despite what has been said above, some philosophers have in fact been willing to question the truth of the basic principles of logic. Here are three possible reasons for doubt:

1 We cannot be sure that the laws of logic do not simply describe the way we *think* rather than the way the universe *is*. G. K. Chesterton (1874–1936) claimed that 'It is an act of faith to assert that our thoughts have any relation to reality at all' and he concluded from this that 'Reason is itself a matter of faith.'
2 Logic depends on language in that it presupposes that we can organise the world into precise, clear-cut categories. But in reality this is never possible. For example, who can say where 'day' begins and 'night' ends? Even the concept of a banana is fuzzy round the edges; for if we genetically modified a banana one cell at a time, we can imagine a borderline case where it would be impossible to say whether it was still a banana. This point was well summarised by the philosopher Bertrand Russell (1872–1970):

> The law of excluded middle is true when precise symbols are employed, but it is not true when symbols are vague, as, in fact, all symbols are.

3 If we take seriously the idea that everything is constantly changing, then nothing stays the same long enough to be identical with itself, and there is nothing for logic to be true of. I think this is what the Greek philosopher Heraclitus (*c.* 540–470 BCE) was drawing attention to when he famously observed that 'You can never step in the same river twice.'

The above doubts are very abstract in nature, but they show that it is possible to doubt even the basic laws of logic. In practice, however, it is impossible to imagine abandoning logic; for if we did, the whole structure of knowledge would collapse.

Can inductive reasoning be doubted?

Let us now consider how far inductive reasoning can be doubted. We saw earlier that induction cannot give us certainty because it involves a jump from 'All observed *X*' to 'All *X*'. To illustrate the extent to which well-confirmed generalisations can sometimes let us down, consider the following story about some 'inductive turkeys' that arrive on a farm one January. They are well looked after, and every morning after breakfast the farmer comes and feeds them. After a few weeks, some of the more philosophical turkeys begin to notice that *whenever* the farmer appears they get fed. As good inductive turkeys they continue to observe patiently, and as January turns to February they become increasingly confident of the truth of the generalisation that 'Whenever the farmer comes, we get fed.' The months pass, and as spring turns to summer, and

summer turns to autumn, this generalisation acquires the status of a law of nature. The connection between the farmer's appearance and the arrival of food is, the turkeys decide, a brute fact about reality, and to question it would be a clear sign of insanity. Things continue in much the same way until one cold December morning – 24 December to be precise – the farmer breaks the neck of the first turkey that comes up to him to be fed. (British people traditionally eat turkey for lunch on Christmas day.)

1 To what extent do human beings sometimes act like the turkeys in this story?

2 The turkeys turned out to be wrong, but do you think that their belief was reasonable? What does this suggest to you about the relationship between reason and truth?

The story about the inductive turkeys may be a fairy tale, but it alerts us to the fact that even well-confirmed generalisations can fail us. For example, Newton's laws of motion were confirmed by observational evidence on countless occasions and were believed to be true for more than 200 years. Nevertheless, they eventually turned out to be false (or, at best, approximations to a deeper truth).

Despite the obvious survival value of inductive reasoning, we might ask how we can know that the future will be similar to the past *in any respect*. How can you be sure that the laws of physics, together with the countless everyday regularities that you take for granted, won't suddenly break down tomorrow? Imagine, for example, that you wake up tomorrow morning and discover that you have been transformed into an insect, like the character in Franz Kafka's (1883–1924) novel *Metamorphosis*. This is the stuff of nightmares, and you might reasonably insist that you *know* that this will not happen. After all, the world exhibits demonstrable regularities that prohibit you from turning into an insect. This has certainly been true up until now; but how can you be sure that the laws of nature won't suddenly break down tomorrow?

Most people do not lie awake at night worrying about whether or not the laws of physics will continue to hold in the future; but the question is whether we can *justify* our confidence in the comforting regularities of nature. You might argue that we know the future will be similar to the past on the basis of experience. For example, last Tuesday I predicted that on Wednesday – which was then in the future – the laws of physics would continue to hold true – and they did. And on Wednesday I predicted that they would continue to hold true on Thursday. And you know what? They did again! So it would seem that there is in fact a huge amount of evidence that the future will be like the past. The problem, however, is that, although the laws of nature held true in *past* futures, this does not prove that they will continue to hold true in *future* futures. From a logical point of view, it is possible that tomorrow, for the first time, they will break down.

Since inductive reasoning moves from the observed to the unobserved, there is in fact no way we can justify our belief in it on the basis of experience. And since it lacks the certainty of deduction, we cannot give a logical justification of it either. Therefore, it would seem that we cannot justify induction at all. So perhaps we should conclude that it is simply an *instinct* that we share with animals.

However, we might look at the situation in another way, and argue that *using inductive reasoning is simply part of what it means to be rational*. For, although we sometimes question the validity of a particular generalisation, it makes no real sense to question the general idea of using the past as a guide to the future. To see this, just imagine someone sticking their hand in a fire every day on the grounds that, although it has always hurt in the past, they have no reason to think that it will hurt them this time. You would surely say they are mad – and rightly so! For as the Scottish philosopher David Hume (1711–76) observed: 'None but a fool or madman will ever pretend to dispute the authority of experience.'

Lateral thinking

In the previous section, we saw that, although philosophical doubts can be raised about both deductive and inductive reasoning, it would be difficult if not impossible to survive without making use of them. Having said that, it is worth pointing out that we can sometimes become trapped in what has been called 'the **prison of consistency**'. The point is that once you have taken a position on something, you may find it difficult to change your mind without losing face. As the Russian novelist Leo Tolstoy (1828–1910) once observed:

> I know that most men, including those at ease with problems of the greatest complexity, can seldom accept even the simplest and most obvious truth if it is such as would oblige them to admit the falsity of conclusions which they have delighted in explaining to colleagues, which they have proudly taught to others, and which they have woven, thread by thread, into the fabric of their lives.

So perhaps it would be better if we all had a little more intellectual flexibility, and followed the example of the economist John Maynard Keynes (1883–1946). When a critic complained that he had changed his opinion about something, Keynes retorted 'When I discover I am wrong, I change my mind. What do you do?'

1 Which do you think is easier: having the courage of your convictions, or having the courage to question your convictions?

2 'The madman is not the man who has lost his reason. The madman is the man who has lost everything but his reason' (G. K. Chesterton, 1874–1936). Should you always try to be as rational as possible, or are there dangers in being too rational?

According to Edward de Bono (1933–) if we are to escape from the 'prison of consistency', then we must learn to 'think outside the box' and come up with more creative ways of looking at problems. To help us to do this, he has developed a way of reasoning called **lateral thinking** which complements traditional, 'vertical' logic. De Bono describes the difference between the two ways of thinking as follows:

> Vertical thinking [i.e. traditional logic] is digging the same hole deeper; lateral thinking is trying elsewhere.

His point is that, since we cannot rely on traditional logic to give us new ideas, we need to adopt a more creative way of thinking that encourages us to search actively for better solutions to problems.

"Never, ever, think outside the box."

Figure 5.6

1 Give a rational explanation for each of the following situations. In each case you will need to question your assumptions and try to 'think outside the box'.
   - **a** A man walks into a bar and asks the barman for a glass of water. The barman pulls out a gun and points it at the man. The man says 'Thank you' and walks out.
   - **b** A man is lying dead in a field. Next to him there is an unopened package. There is no other creature in the field. How did he die?
   - **c** Anthony and Cleopatra are lying dead on the floor of a villa in Egypt. Nearby is a broken bowl. There is no mark on either of their bodies and they were not poisoned. How did they die?
   - **d** A man rode into town on Friday. He stayed three nights and then left on Friday. How come?

2 Two boxers are in a boxing match (regular boxing, not kick boxing). The fight is scheduled for 12 rounds but ends after 6 rounds, after one boxer knocks out the other boxer. Yet no man throws a punch. How is this possible?

3 In your cellar there are three light switches in the OFF position. Each switch controls one of three light bulbs on the floor above. You may move any of the switches but you may only go upstairs to inspect the bulbs one time. How can you determine the switch for each bulb with one inspection?

4 A landscape gardener is given instructions to plant four special trees so that each one is exactly the same distance from each of the others. How would you arrange the trees?

5 Connect the nine crosses below using only four straight lines and without taking your pen off the paper.

X X X

X X X

X X X

Figure 5.7

Conclusion

At the beginning of this chapter, we saw that rationalist philosophers such as René Descartes believed that reason is a way of knowing that can give us certainty. But we have seen that this belief is open to serious doubt. For reason is only as certain as the premises on which it is based, and it is always possible that we have reasoned badly in arguing from premises to conclusions. We also raised various philosophical doubts about deduction and induction, but in practice it is difficult to see how we could do without these two ways of reasoning.

What seems to come out of our discussion is that reason, like other ways of knowing, is a double-edged tool. We need reason to develop consistent beliefs about the world, but we can sometimes become trapped in the 'prison of logic' and this can stifle our creativity. Furthermore, reason is not appropriate in every situation, and if someone is *too* rational they may simply come across as a cold and unfeeling automaton. In private life, for example, the best way to resolve a dispute with a loved one may not be by proving their inconsistency to them but by showing them empathy and understanding. In other words, reason needs to be balanced by emotion. We must now look at emotion and see in what way, if any, it can contribute to our knowledge of the world.

Answers to selected questions

Uncritical inference test (pages 122–3)

All of the statements are uncertain except (3), which is false, and (6), which is true. If you answered differently, you might want to go back to the story and look more closely at it.

Lateral thinking questions (pages 136–7)

1a The man has hiccups.
1b The man's parachute failed to open.
1c Anthony and Cleopatra are goldfish.
1d Friday is the name of the man's horse.
2 The boxers are women.
3 Turn switch 1 on for about five minutes and then turn it off. Turn switch 2 on and then go upstairs. The hot unlit bulb is controlled by switch 1, the lit bulb by switch 2, and the cold unlit bulb by switch 3.
4 Plant 3 trees equidistant from each other in an equilateral triangle. Then build a mound of the right height in the middle of the triangle and plant the fourth tree on top of it.
5 As the diagram below shows, if you extend one of the lines outside the square formed by the dots, the solution is easy.

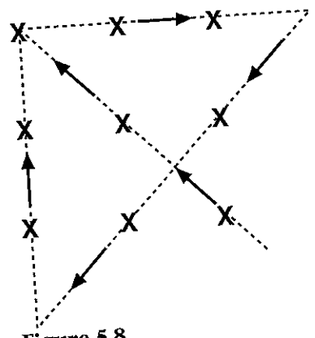

Figure 5.8

Key points

- Through reason we can acquire knowledge about the world that goes beyond the immediate evidence of our senses.
- According to rationalism, reason is a more important source of knowledge than experience, and we can discover important truths about reality by using pure reason.
- Deductive reasoning moves from the general to the particular, and inductive reasoning moves from the particular to the general.

- Pure logic is only concerned with the *structure* of arguments and the validity or invalidity of an argument is independent of the truth or falsity of its premises.
- When deductive reasoning is applied to the real world it is no more certain than the (inductively derived) premises on which it is based.
- Inductive reasoning sometimes leads to our making hasty generalisations which are then reinforced by our tendency to only notice things which confirm them.
- There are many other 'informal' fallacies that people sometimes commit when discussing things in everyday life.
- The main causes of bad reasoning are a combination of ignorance, laziness, pride and prejudice.
- Despite appearances, it is possible to doubt the certainty of even the basic laws of logic such as the law of identity.
- Although it is hard to see how we can justify our belief that the future will be relevantly similar to the past, this belief has obvious survival value.
- We sometimes get trapped in the prison of consistency and find it difficult to change our minds about things or look at them from a new perspective.

Terms to remember

ad hominem
argument *ad ignorantiam*
begging the question
belief bias
binary thinking
circular reasoning
confirmation bias
contradiction
deduction
double standards
enthymeme
equivocation
fallacy
false analogy
false dilemma
hasty generalisations
induction/ inductive inference
infinite regress
lateral thinking
laws of thought
loaded questions
post hoc ergo propter hoc
premise
prison of consistency
quantifier
rationalisation
rationalism
rhetoric
special pleading
syllogism
validity
Venn diagram
vested interest
vicious circle

Further reading

R. H. Thouless and C. R. Thouless, ***Straight and Crooked Thinking*** (Hodder and Stoughton, 1990). A useful and readable book which explores the most common reasoning errors and tricks that are used in argument to deceive people. The fallacies that are discussed are clearly explained and well-illustrated.

Stuart Sutherland, ***Irrationality: Why We Don't Think Straight*** (Rutgers University Press, 1992). Written by a psychologist, this book explores the many ways in which our thinking can go wrong. Among the topics covered are conformity, misplaced consistency, ignoring evidence and false inference.